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16. ABSTRACT

This article is an edited version of an address before the Great Lakes Pollution Monitoring Workshop sponsored by the National Oceanic and Atmospheric Administration (NOAA) in Ann Arbor, Michigan, February 11-12, 1981. Current and historical efforts in Great Lakes monitoring are reviewed. The contributions of the Great Lakes Information and Surveillance Plan (GLISP) to existing knowledge of the ecosystem are discussed. An ecosystem approach to toxic substances in the Great Lakes is presented and recommendations for implementing the surveillance plan for consideration of toxic organic substances are made.

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FOCUS On Water Quality

VOLUME 7 - ISSUE 1 MAY 1981

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ECOSYSTEM MONITORING IN THE GREAT LAKES: RESEARCH NEEDS, PUBLIC HEALTH IMPLICATIONS

by Wayland R. Swain

I am pleased to be here today to discuss with you Ecosystem Monitoring in the Great Lakes. Most of my comments concerning research needs and public health implications will deal with residue forming toxic organic substances of anthropogenic origin since, in my opinion, issues in this area are rapidly reaching crisis proportions.

Editor's Note...

The above article is an edited version of remarks presented before the Great Lakes Pollution Monitoring Workshop, National Oceanic and Atmospheric Administration, held in Ann Arbor, Michigan on February 11-12, 1981.

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WATCH FOR NEW FOCUS FORMAT — NEXT ISSUE

Here is what a Michigan poet has to say:

"Man could not seem to understand
--that the things he called pests
were part of the living universe
--that each one had as much right
to its tiny spot on earth
as man to his . . .

He refused to recognize
that chemicals he had compounded
to kill these things en masse
could be carried by the winds and the waters-
--and encircle the earth
and come down again
with the rains and the dust
affecting the life of everything that
breathes . . .

He tried to believe
that chemicals had no effect on man - -
unable to comprehend - - -
that diversity was indispensable - - -
that all the natural balances
- - and counterbalances - - -
were vital to the whole . . .

That - - -
nature was the supreme regulator of life - - -
- - - - - - not man . . .

The great dilemma man faced
was the result of his quest
for an easy - convenient
way of life - - - -
- - and his pursuit of relaxation
from that life . . .

It was not the fulfillment of his needs
but his insatiable desires
that led to his undoing."[1]

When the poets achieve this sort of ecological understanding, the problem is clearly of large proportions, and of interest to a substantially large fraction of the population.

Apparently reflecting our incredible ignorance, we have displayed astounding ingenuity in despoiling the vast ecological system of which we all are a part. On a worldwide basis, probably one of the best historical examples of this kind of man-induced environmental crisis as a result of ignorance occurred with the use of one of these persistent, residue-forming chlorinated hydrocarbons of anthropogenic origin -- DDT.

It involved an obscure animal from the Malaysian Archipelagos, the Gecko Lizard. A fairly shy and soft-skinned creature, the Gecko has one all-consuming passion...cockroaches. Failure to realize this single fact led ultimately to the world's most unusual airlift. It happens that malaria was widespread in Malaysia. In an effort to control mosquitoes, the Malaysian Government undertook massive spraying with DDT. The poisoned mosquitoes were then devoured by roaches, which in turn fell prey to the Geckos. The residual poison was not sufficient to kill the hardy little lizards, but it did affect their central nervous system, slowing them down and making them easy targets for hungry cats. The cats, however, were very vulnerable to DDT and died by the hundreds. As the cat population declined, the number of rats skyrocketed, bringing both terrible economic loss and the threat of an explosive outbreak of Bubonic Plague (The Black Death). At this point, the World Health Organization stepped in and recommended discontinuation of DDT; and then -- to restore the ecological balance -- they airdropped planeload after planeload of cats into remote areas where the rats roamed fearlessly.

Like certain other animals, man has a remarkable propensity to foul his own nest, but he seems to be the only species on earth who then attempts to chop the tree down behind him.

To what extent have we created problems for ourselves in the Great Lakes? Notice I said problems *we* have created, for we are talking about xenobiotic substances of anthropogenic origin -- compounds that are not biologically manufactured, that are foreign to living materials, and that are made by man. We have discovered some 400 of these compounds in Great Lakes water, sediments, and biota in the last five years. Let's consider only one of these substances, using it as an indicator or tracer substance, and as a substitute or surrogate compound representative of a group of poorly degradable, persistent, residue forming substances.

The class of compounds I have selected is PCBs, polychlorinated biphenyls. To adequately describe the overall impacts of these substances, we need a conceptual framework or design. I propose to use an ecosystem approach for this consideration. Giving particular attention to the Upper Great Lakes -- Superior, Michigan and Huron -- the input sources to the system are three.

1. Atmospheric inputs,
2. Tributary loads, and
3. Direct discharges.

Fuels are burned for a variety of human needs, and other anthropogenic activities contribute to the PCB contamination of the atmosphere. The materials are ultimately returned to the lakes by way of precipitation, condensation, and dry deposition. Over Superior, the atmospheric concentration has been shown to be 1.5 ng/m$_3$.

PCB inputs from the other major sources, tributary streams and direct discharges, are highly variable in both space and time.

Current best estimates suggest that 90 to 95 percent of the input loading values for PCBs are derived from atmospheric sources. It appears that somewhere near 9 metric tons per annum of this compound is contributed to Lake Superior from the atmosphere, and about 0.5 metric tons from all other sources. For Lake Michigan, present best estimates suggest 70 to 75 percent of the total annual load is derived from atmospheric sources.

The loading values, particularly that portion derived from atmospheric sources, are incorporated in the water masses of the Upper Lakes. This enormous reservoir - undoubtedly the result of at least intermediate, and probably from long range transport - drives the concentration of open lake values to the extent of 2 to 10 ng/L (parts per trillion). Areas of embayment and concentration are frequently higher, but average ambient lake values seem to fall in the general range of 2 to 10 ng/L.

The planktonic constituents living in the surrounding milieu tend to biomagnify the levels of PCB to the order of 20 to 200 ng/g (parts per billion).

The planktonic constituents of the second trophic level in turn fall prey to the consumers of the next trophic level, the Great Lakes fish. By means of both food chain increase (bioaccumulation) and by way of direct uptake across gill membranes (bioconcentration), the fish species of particular concern to us, the sports species, achieve levels in a range of 2 to 20 mg/kg (parts per million). The sediments act alternately as both a sink and a source of pollutant materials depending on a variety of naturally occurring processes: adsorption, desorption, sink rates, wind driven resuspension, and the like.

For the first time in 50 years of science on the Great Lakes, it has become necessary to consider man as a truly reciprocal and interactive part of

***ECOSYSTEM MONITORING** . . . cont'd on page 8*

IJC AGREEMENT ACTIVITIES CONTINUE

Though the International Joint Commission currently has only one member, its work under the Great Lakes Water Quality Agreement continues through the activities of its advisory boards.

On March 19-20 the Great Lakes Water Quality and Science Advisory Boards sponsored a Workshop on Cancer Registries. It was the first event sponsored under the 1978 Agreement to consider the Great Lakes Region with its 37 million inhabitants from the perspective of human health. The workshop brought together professionals from state, federal and provincial health organizations which have or are developing such registries.

A cancer registry contains records on the cancer cases newly diagnosed in a defined population such as a state or province. The registry record contains information on a patient's type of cancer, age, sex, race, city of residence, age when diagnosed, types of treatment, etc. Registries are used to compare rates of cancer occurence between regions and identify areas where further investigation is needed, to monitor change over time, and to provide valuable resource information to researchers investigating causes of cancer. The workshop was a first step to assist the Great Lakes Basin jurisdictions to develop compatible registries.

Under the terms of the 1978 Agreement there is a strong emphasis on the control of toxic substances. One implication of that emphasis is that some method needs to be developed to set up an early warning system in which human health effects related to drinking water would play a significant role. Compatible cancer registries would be an integral part of any such system.

The question which the workshop chairman Dr. Robert F. Spengler, of the Ontario Cancer Treatment and Research Foundation, asked when the event began was: "How can we relate a mixture of chemicals to a mixture of diseases called cancer, a disease caused by a mixture of variables, a disease which can be detected after what is often a latency of several decades?" A critical step in being able to establish such relationships is to have compatible registries.

The workshop was designed to examine the characteristics of the presently existing registries covering the Great Lakes Basin, determine how specific the data are which are now available in national centers to Great Lakes researchers, and to recommend procedures for the development of a uniform format to be used for Great Lakes Basin cancer registries which would include additional demographic data.

Proceedings of the workshop will include the participants' recommendations.

Dr. R.F. Spengler, Ontario Cancer Treatment and Research Foundation, Toronto, (Workshop Chairman) and speaking, Dr. W.S. Burnett, New York State Department of Health, Albany.

BRIEFS

Argonne National Laboratory released results of a two-year study in December 1980 describing the negative effects on soybean yields of sulfur dioxide concentrations which were below United States Environmental Protection Agency limits.

For details write Argonne's Office of Public Affairs, Argonne, Illinois 60439 or call (312) 972-5575.

The Michigan Natural Features Inventory (a joint project of The Nature Conservancy and the DNR) needs help in developing a comprehensive data base on the natural features of Michigan for use in land use and preservation planning. For each feature, (rare plants, animals, aquatic habitats, etc.) information is needed on the location and quality of occurrences. If you would be willing to conduct a survey for significant features in your area, please contact: Natural Features Inventory, Land Resource Programs Division, Michigan Department of Natural Resources, P.O. Box 30028, Lansing, MI 48909, (517) 373-3328. (from *SEMCOG Calendar*)

MUCC is the Michigan United Conservation Clubs, a statewide organization dedicated to further and advance the cause of the environment and conservation in all phases and to promote programs designed to educate citizens in natural resource conservation and environmental protection and enhancement. Its activities include:

- Conducting conservation and environmental education programs;
- Maintaining a full-time legislative service providing information relating to conservation and environmental matters to the State Legislature;
- Engaging in legal suits to protect the state's natural resources;
- Publishing *Michigan Out-of-Doors*, a monthly magazine devoted to conservation and outdoor recreation;
- Serving as the official Michigan affiliate of the National Wildlife Federation;
- Operating the MUCC Conservation Education Youth Camp;
- Conducting hunter safety training programs throughout Michigan;
- Monitoring governmental, industrial, military, and other operations affecting natural resources;
- Sponsoring National Wildlife Week in Michigan;
- Publishing *Tracks*, a monthly tabloid reader covering conservation subjects for elementary school children throughout the state;
- Conducting Wildlife Discovery, a conservation education program, in classrooms in various parts of the state;
- Publishing books on conservation subjects, map books, recreation guides, hydrographic maps, and other educational materials relating to conservation and the outdoors;
- Conducting the largest shotgun, rifle, pistol, and archery tournament in Michigan;
- Arranging conferences to train leaders in the conservation movement;
- Maintaining a conservation library, including a low cost film loan service;
- Informing the general public regarding developments and issues on the conservation front;
- Sponsoring "Detroit Outdoorama," the largest sports exposition in Michigan;
- Coordinating National Hunting and Fishing Day in Michigan; and
- Managing Wildlife Impressions, an art gallery and wildlife print service.

For more information write to MUCC, P.O. Box 30235, Lansing, Michigan 48909, or call (517) 371-1041.

LAW AND THE COURTS

Michigan is losing farm land at the second greatest rate in the nation: 115,000 acres per year. Among recommendations proposed to slow the loss are exclusive agricultural zones, state agricultural development bonds to provide low-interest farm loans and treating agriculture as a target industry for economic and job development. A new law HB 5385 (PA 501) makes changes in the Economic Development Corporations Act and specifies that EDC's could be used for agricultural and forestry projects. (*Capitol Captions*, Februarv 12, 1981).

"Canadian concerns about acid rain from the U.S. may be addressed under Section 115 of the Clean Air Act, the Environmental Protection Agency has decided. Implementing this section of the act requires that the following two conditions be met: Canada would have to have legislation to control pollution from within its borders that affects the U.S., and a "duly constituted" international agency must find that U.S. pollution is endangering Canada.

In a recent analysis of Section 115, EPA concluded that the 1980 annual report of the International Joint Commission constitutes a sufficient finding by an international agency of harm to Canada from U.S. pollution (A/WPR, Nov. 17, 1980, p. 456). The agency further found that legislation authorizing control of pollution affecting another country was passed by the Canadian Parliament on December 17 and, if fully implemented by the Canadian government, would provide the U.S. with sufficient protection to meet the requirements of Section 115.

Initiation of the Section 115 provision would commence with a notification to certain states that they must identify and propose pollution control measures to protect the other nation's air quality. EPA staff are now working toward a decision on which states should be notified". (Reprinted with permission from *Air/Water pollution report*, February 9, 1981).

Ontario Hydro will comply with the Ministry of the Environment's regulations and reduce nitrogen oxide and sulfur dioxide emissions by 43% during the next 10 years. About $500 million will be spent, much of that for installing scrubbers on existing facilities. (*International Environment Reporter*, February 11, 1981)

TECHNOLOGICAL ACHIEVEMENTS RECOGNIZED

Since 1976 the United States Council on Environmental Quality and the Environmental Industry Council have presented awards to industries, communities or individuals that have demonstrated leadership in pollution control and environmental protection through technological achievements.

The 70 entries in 1981 were judged according to these criteria: environmental and economic benefits, technological achievements, energy and water conservation, material recovery and creativity. The awards are divided into several categories -- noise, air, water, toxic, and wastewater pollution control; solid waste management, energy conservation and occupational health.

Four of the eight winners are from Great Lakes States.

Air pollution control

In the construction of a new coal-fired power plant in Grand Rapids, Minnesota, ***Minnesota Power and Light*** sought the most cost-effective system for reducing air pollution. It launched a $2 million pilot program which resulted in the choice of a two-stage Peabody venturi-absorber system which meets all EPA standards at a cost saving of approximately $20 million over more conventional systems.

Hazardous waste control

Goodyear Tire and Rubber Company's Research Division, devised a process for detoxifying PCB-contaminated heat transfer fluids which permitted their recycling at considerable cost savings. The process was found to be effective at high PCB levels. The company has donated the technology for the process to the public.

Solid waste management

Finch, Pruyn & Company of Glen Falls, New York, a manufacturer of fine papers, combined a unique system of waste bark disposal with substantial energy conservation. A new bark-drying system utilizing Swedish technology was added to the pin-hole grate boiler originally designed for bark and fuel oil firing. The firm is now able to convert huge piles of waste damp bark into an oil replacing fuel. This technology is responsible for over $1 million savings a year in fuel costs.

Energy conservation

The ***Diamond Walnut Growers*** of Stockton, California, built a $3.7 million cogeneration power plant, designed to use walnut shells as fuel. The plant produces all the steam necessary to operate the walnut processing facility and sells the excess -- two-thirds of its output -- to a local utility.

At the February 26 presentation, left to right are: Gary Bernegger, president of Hillshire Farm Company, Joseph N. Linssen, president of Foth & Van Dyke, consulting engineers, and Malcom Baldwin, acting chairman of the Council on Environmental Quality.

Land reclamation

Since 1974, when molybdenum mining ended in the Woods Creek Valley of north central Colorado, ***AMAX, Inc.*** headquartered in Greenwich, Connecticut, invested over $7 million in a successful land reclamation project, making beneficial use of other waste products such as sludge from Denver, wood chips from a sawmill and rocks from another mine.

Wastewater treatment

The ***Western Lake Superior Sanitary District,*** of Duluth, Minnesota, was the first full-sized co-disposal facility to use fluidized bed reactors for the simultaneous thermal reduction of sludge and solid waste. Energy is recovered from the process in the form of steam, which is diverted back into the plant for operational use. (See *Focus*. July 1980 for details.)

Overall excellence

In planning the expansion of a major meat processing plant in a popular recreation area, ***Hillshire Farm Company,*** of New London, Wisconsin, insisted on the most stringent pollution controls to protect surface and groundwater resources. Its design engineers, Foth & Van Dyke and Associates, applied a system developed in

Australia which permitted the Wisconsin firm to exceed all state and federal environmental requirements. In addition, this waste treatment facility became the first of its kind in the United States to produce usable by-products for the pharmaceutical and photographic industries.

For the 1981 awards program Russell Peterson, former chairman of the Council on Environmental Quality, served as Chairman of the panel of judges. Dr. Peterson was a primary force behind the development of the National Environmental Industry awards program. His words express the philosophy behind the program and the Environmental Industry Council: "We have all heard it suggested that environmental programs will stop or slow down economic growth. Just the opposite is the case. It is pollution, not its control, that limits growth."

Editor's Note: For details contact the Environment Industry Council, Suite 210, 1825 K Street N.W., Washington, D.C. 20006, (202) 331-7706.

BOOKSHELF

For copies of Martin Pfeiffer and Patrick Festa's report "Acidity Status of Lakes in the Adirondack Region of New York in Relation to Fish Resources", write to New York Department of Environmental Conservation, 50 Wolf Road, Albany, New York 12233.

"Lake Erie Coast: A Field Guide" is an attractive 32 page guide on the lake's history, erosion, pollution and industries. In exacting details, it describes 28 tour sites and activities including maps, addresses, directions, cost, time of day and year to visit, telephone numbers of people to contact and suggestions for projects. For more information contact David Greene, Sea Grant, Extension Program, Farm & Home Center, 21 South Grove Street, East Aurora, New York 14052, (716) 652-5453.

"This Coast is Our Coast" is a self-guided Ohio tour map featuring little known wetlands, well known parks and the Lake Erie islands. Preparation of the map was funded by the League of Women Voters Education Fund. The map is available for $1.00 (US) from the League of Women Voters of Ohio, 65 South Fourth Street, Columbus, Ohio 43215, (614) 469-1505.

A New York State Acid Precipitation Directory has been published by Cooperative Extension - USDA, Cornell University, Center for Environmental Research, 468 Hollister Hall, Ithaca, New York 14853, (607) 256-7535.

Two new publications available free from Sea Grant Communications Office, (1800 University Avenue, Madison, Wisconsin 53706) are *Fish of Lake Superior* (WIS-SG-76-124) and *Fish of Lake Michigan* (WIS-SG-74-121), both written by Warren Downs and illustrated by Christine Kohler.

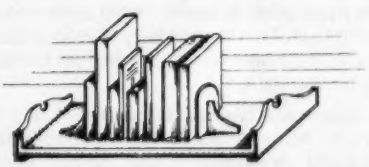
If you are responsible for developing and initiating specific lessons and programs in outdoor education, you will find this book "Hundreds of Ideas for Outdoor Education" to be an idea bank. This teaching aide provides a stimulus to program planning and a reference base that can be quickly and easily consulted. The wide range of topics includes animals, plants, seasons, habitats, geology, insects and spiders, weather, wildflowers, Indian life, horticulture, birds, early Americans, ecology, astronomy, arts and crafts, photography, edible plants, and many more. Available for $8.50 from: The Interstate Printers and Publishers, Inc., 19-27 North Jackson Street, Danville, Illinois 61832. (From *Water Impacts*, MSU Cooperative Extensive, May 1980).

The U.S. Environmental Protection Agency has published the first in a series of reports describing the results of a study on lead and cadmium poisoning.

The report reveals that both metals can affect the central nervous system, causing such problems as hyperactivity. They can enter the natural food chain through such routes as drinking water supplies contaminated by coal cleaning wastes.

The first report of the series, "Chronic Toxicity of Lead and Cadmium", details the effects these metals have on the central nervous systems of parental generation rats. Future reports derived from the same project will describe lead and cadmium toxicity in the central nervous and reproductive systems of offspring rats.

Single copies of the report are available in limited quantity through ORD Publications, Center for Environmental Research Information, U.S. EPA, Cincinnati, Ohio 45628. When ordering, refer to publication number EPA-600/1-80-012.



University of Windsor

by Marie Sanderson

History

In January 1981, a new member joined the family of University Institutes devoted to Great Lakes research. This illustrious family includes the Center for Great Lakes Studies at the University of Wisconsin - Milwaukee, the Center for Lake Erie Area Research at Ohio State University and the Great Lakes and Marine Water Center at the University of Michigan. This new member is unique in that it is the only university based agency in Canada devoted to Great Lakes studies. This may seem incredible when it is remembered that 50 percent of Canada's population and more than 90 percent of the population of Ontario live in the Great Lakes Basin.

The new Institute will not be in competition with, but rather will co-operate with the Canada Centre for Inland Waters (CCIW), an excellent research institute operated by the federal government in Burlington, Ontario, and also with such U.S. government research institutes as the Large Lakes Research Station in Grosse Ile, Michigan.

The geographic location of Windsor in the centre of the Great Lakes Basin and on the international border between Canada and the United States makes it an ideal locale for a centre for Great Lakes studies. Situated on the Detroit River, one of the busiest waterways in the world, Windsor residents feel very much a part of the great inland water system. Possibly for the same reason, the Great Lakes Regional Office of the International Joint Commission is located in Windsor. It is hoped the Institute and the IJC will be of mutual benefit to each other.

University of Windsor

The University of Windsor is the most southern University in Canada. It is a new university in some ways since its charter from the Province of Ontario dates only from 1963. But it had a long history. More than one hundred years ago in 1857, a group of Jesuits founded the original Assumption College on the banks of the Detroit River. Today Assumption University, now run by Basilian fathers, is one of the affiliated units of the University of Windsor. It is still on the banks of the Detroit River at the place where the bridge to Detroit now begins. It is fitting that the coat of arms of the University contains a bridge. It is symbolic of the location of the university near the bridge linking Canada and the United States, and of the principal aim of the university - to bridge chasms of ignorance and join the firm grounds of truth.

The University in 1981 remains relatively small, with some 7000 students and a faculty of approximately 500. It has faculties of arts, science, social science, education, engineering, law, business administration, and human kinetics. A research interest in the Great Lakes was natural for faculty members at the new University of Windsor when it expanded its focus from classical studies to social science, science and engineering. Several professors in geography, biology, civil engineering and geology became active in the International Association for Great Lakes Research which itself began only in the 1960's.

The University, with the Ontario Ministry of Natural Resources, hosted the very successful 22nd IAGLR Conference in 1978. With a widened interest in the Great Lakes as a result of the Conference, planning began for a Great Lakes Institute. A proposal was made to the Senate and the Board of Governors of the University and the Institute became a reality in January 1981.

Institute Members

Membership in the Institute is open to all faculty members and scientists in nearby government agencies with interests in the Great Lakes. The primary purpose of the Institute is to solve environmental problems in the Great Lakes Basin ecosystem - not just on the lakes themselves. For this reason, the Institute has members from many disciplines. Its director is a geographer and the faculty members of the Executive Council are from Civil Engineering, Biology, Law, Economics and Geology.

Input to the Executive Committee from outside the university is important and the Council includes members from business and the federal and provincial levels of government. The institute has the expertise of some thirty physical and social scientists. In Biology the expertise includes phytoplankton ecology, algal physiology and biotoxicity; in Civil Engineering, the disposal of municipal and industrial waste waters, river ice mechanics; in Geography, water balance, beach erosion, lake ice, precipitation chemistry; in Geology, subsurface waste disposal, ground water studies; and in the Social Sciences and Law - environmental policies and planning and management of public recreational sites and environmental law. There are well equipped laboratories on the main campus and a research

station on Lake Erie's shore.

A brochure describing the Institute and its facilities in both the official languages of Canada has been produced and can be obtained by writing the Institute at the University of Windsor.

The Institute is seeking grants and contracts from government and private agencies to conduct interdisciplinary research in many aspects of the Great Lakes ecosystem. Currently under discussion is research in precipitation chemistry of which acid rain is one part. Investigation must be done on the complete life cycle of the pollutants - from source, to air trajectory, to concentrations in the air and in precipitation, and to effects on plant and animal life. Other areas which are of interest are the possibility of year round navigation on the lakes, the recreational use of the lakes, and the effect on the lakes and their ecosystem of the nuclear plants on their shores. All of these concerns will be discussed at a symposium to be held at the University of Windsor on May 21-22 entitled "The Great Lakes in the 80's". The symposium will be open to the public (see announcement this page).

About the Author

Dr. Marie Sanderson was educated at the Universities of Toronto, Maryland and Michigan. She joined the faculty of the University of Windsor in 1956. In March, 1981 Professor Sanderson was elected the first Director of the newly established Great Lakes Institute.

ECOSYSTEM MONITORING . . . *cont'd from page 1*

the Great Lakes ecosystem. Up to now we have had the luxury of regarding ourselves as simply contributing to "source inputs" to the ecosystem equation. Suddenly, it is becoming painfully evident that as "top predators" in the Great Lakes food web, mankind has collectively become a "reservoir" or "sink" term in the ecosystem toxic substances mass conservation expression.

Public consumption of Great Lakes fish heavily contaminated with PCBs is controlled effectively through the embargo of commercial catches in the United States by the Federal Food and Drug Administration. However, in the 18 counties of the State of Michigan that border on and about Lake Michigan, there are presently 380,000 licensed sport fishermen. As a group, these sport fishermen and their families consume more than three times the national average of fish per year. Preliminary studies by Dr. Harold Humphrey of the Michigan Department of Public Health have demonstrated what appears to be a direct, nearly linear relationship between the total amount of Great Lakes fish consumed and the absolute circulating titer of PCBs in the blood of these individuals.

Market basket surveys suggest no major differences in levels of contamination of all other foods consumed in the Great Lakes area as opposed to other North American sites. Thus, it is felt that major differences between areas based on other sources of food can be ruled out, thus concentrating strictly on Great Lakes fish. Considering that the major relative burden to the food category of Lake Michigan Basin resident populations is derived through Great Lakes sports species of fish, it is necessary to examine the relative magnitude of other kinds of input terms into the question of human exposure to PCBs. For this compound, among non-occupationally exposed individuals, the additional sources are two: respired ambient air and potable drinking water.

A quick calculation for the average annual exposure from orally ingested drinking water suggests very minimal levels, even assuming that mean raw water values at approximately 4 ng/L are used. We are presently fairly confident that finished drinking water levels are at least an order of magnitude below raw water values.

When one examines the potential for respiratory exposure, similar relationships are observed. Assuming complete and instantaneous sorption and selective uptake of PCBs at the alveolar surface, based on an average tidal volume of approximately half a liter, the annual uptake of PCBs through the respiratory route is only on the order of 5 to 10 µg annually. Thus, in terms of exposure potential using "maximum exposure values", it is possible to breathe the air in the Lake Michigan Basin and drink its polished drinking water for years before achieving the same effective exposure that one would receive from eating a single one-pound fish meal of Lake Michigan lake trout.[2]

In people, as well as in Great Lakes biota, there are two possible routes of toxic action, acute toxicity and chronic toxicity. The acutely toxic activity is dose/time dependent. A very high exposure over a very short period of time to exceed the "critical dose" or "effective dose level" is sufficient to produce physical manifestations and symptomatology in adult human populations. This has apparently already occurred in at least one documented case.

Another totally unknown pathway, hence shown in a broken line (Figure 1), is the question

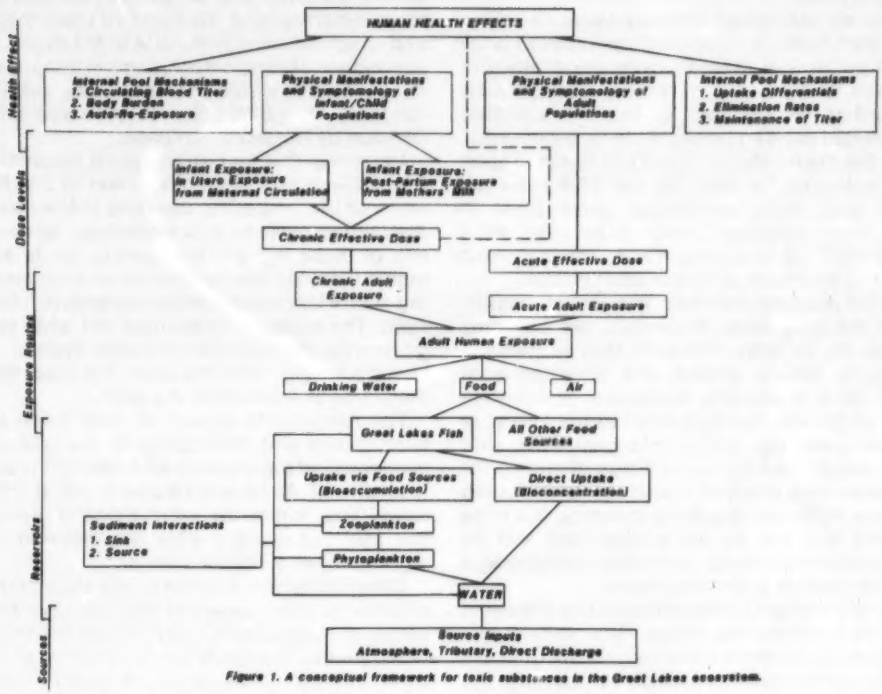


Figure 1. A conceptual framework for toxic substances in the Great Lakes ecosystem.

of long-term chronic impacts. Again, we are sure that any such phenomena will be dose/time dependent, and that it will probably involve a very long lag phase. Typically, with organic toxicants, this period may be in excess of 25 to 35 years.

Of present critical concern, however, is the potential for serious and significant impacts upon selected "high risk" populations. A mother, belonging to the group of consumers who eat large quantities of Lake Michigan sports species of fish, selectively increases her own circulating blood titer of PCBs as a result of additional exposure to fish.

Regrettably, there is transplacental passage of the molecule, so that her unborn child is also exposed to the substance as a result of maternal circulation. Literature values and early Great Lakes experimental efforts suggest that, for the period of 9 months of gestation, the unborn infant may be exposed to a level of 20-50 percent of his mother's blood burden. This exposure comes at a time of unprecedented growth and development, and critical maturation of tissues.

At birth, the child may be exposed to an additional source of PCB as a result of nursing. A recent nationwide survey of 1,038 nursing mothers in the United States demonstrated that approximately a third (309) of the women had PCB in measurable amounts in their breast milk. A more recent study of 1,057 Michigan mothers demonstrated PCB in milk of all participants. In this latter survey, an average level of 2.3 parts per million (ppm) was found.

Among individuals consuming Lake Michigan fish who participated in the early phase of the Michigan blood level PCB study, a single analysis of breast milk was made. The sample was received from a mother in the low exposure class who had consumed 28 pounds of Lake Michigan fish during a two year period (1973-74) approximately one-half of the recommended maximum of 28 pounds per annum.[3] This woman had a circulating blood titer of 0.053 parts per million PCB. A breast milk sample collected the same month as the blood sample contained 4.0 ppm PCB on a fat basis (2% fat content), equivalent to 80.0 parts per billion (ppb) PCB on a whole milk basis. This value is substantially above the levels reported in the literature for the general population and for the portion of Michigan residents unexposed to large quantities of Lake Michigan fish. On the basis of present work, the value reported for this sample is not unusual for breast milk from women exposed to substantial quantities of Lake Michigan fish.

It can be reasonably assumed that a nursing infant will consume 1 kg of breast milk per day. At a level of 80 ppb, the child is exposed to 80 μg of

PCB each day.

Dose, as contrasted with exposure, is calculated upon mass of compound per mass of body weight per unit of time. To carry the analogy of exposure to dose, it is necessary to make only one further assumption, i.e., that a reasonable birth weight is 3-4 kg (approximately 6-8 pounds). Thus, the dose rate for a child of these proportions would be between 20 and 26.6 parts per trillion (ppt) body weight/day, some 20 to 25 times the maximum daily dose rate of 1 ug/kg/day PCB recommended by the U.S. Food and Drug Administration for adult intake.

Internal pool mechanisms may be very important in the long view. At present, we can only surmise. We do know, however, that as the child undergoes natural growth and developmental cycles, he is repeatedly subjected to intensive spurts of growth in which most of the available fatty materials are drawn into circulation and metabolized to aid in the provision of energy for the tremendous anabolic activities that are going on. Since PCBs are lipophylic in nature, it is to be expected that the stored contaminant will be mobilized in the body fat, potentially producing a selective form of auto-reexposure.

What is the effect of this activity? The answer is simplicity itself: no one knows. What is known is that much of the mobilization would occur at the times when the myelin sheathes surrounding the central nervous system are being laid down. Myelin, of course, is an insulating substance and is composed largely of lipid materials. Thus, it may be reasonably expected that some impact on the body's centers of higher integration will result.

One can continue to speculate. It is possible to hypothesize any of a number of additional consequences. The fact is, as yet we simply don't know. But, as the evidence accumulates, it becomes increasingly clear that the *potential* for health consequences may be beyond our original expectations.

Now, how does all this relate to surveillance and monitoring of the Great Lakes? The fundamental data base that set this study in motion, which resulted in what appears to be presently the most complete ecosystem assessment for a group of toxic substances, was originally achieved by research components and surveillance and monitoring groups working hand in hand. Research and surveillance groups combined to put together the Upper Lakes Reference Group for the IJC. Together they designed the plan of programs, together they carried out the study, and the continuing remedial actions and efforts toward control are still being carried out by the surveillance and monitoring groups. To be more specific, the very first study which demonstrated the range and scope of accumulations of toxic substances in the biota of Lake Superior, and which gave the first clues to the extent of the atmospheric transport problems in this area -- the basis for the whole previous data set -- was funded by the EPA's Surveillance and Analysis Division of Region V, Chicago.

I mention this fact at this point because I believe I see a very disturbing trend in the discussions of the preceding day, and in the materials distributed prior to this workshop. Nowhere in any of those items -- the agenda, or its attachments -- could I find comments on what the existing surveillance and monitoring system has done right. The question raised was *not* what can we do to make the surveillance better. Instead, it was "what's wrong" with the plan, the data, and the programs to implement the plan.

The documents appear to cast Great Lakes surveillance and monitoring in the role of the desperado of the old west who was captured by a local sheriff. As he was hauled to jail, the sheriff said, "Yup, tomorrow we're a'gonna give you a *fair trial*, ...and right after the hanging, we're a'gonna have a square dance."

Considering the questions, the statements applicable to other areas of the country, and the range of suggestions I have heard for addition, deletion and change to the monitoring program on the Great Lakes, it would appear that this workshop seeks to add, piecemeal, to what is otherwise a reasonably consistent plan.

I am reminded of H.G. Wells' parable of "The Pig on Provinder Island." You may recall that Wells' parable was about three sailors and a small cabin-boy shipwrecked on an island inhabited by a pig. On becoming aware of this pig, they simultaneously became aware of a nearly intolerable craving for bacon. The oldest sailor, remembering a delicious ham his father carved up for a special occasion, set as his objective the left ham. The second sailor, remembering a delicious roast loin at his sister's wedding, set as his objective a loin chop. The third settled on chitterlings. The cabin-boy proposed that they hunt the entire pig and kill it; but his suggestion was ridiculed as far too complex to be feasible. The result of the hunt was that just as each sailor almost reached his objective, the pig ran off with it; and the cabin-boy, being too small to dig a large enough pit without the help of the others, only succeeded in catching the hunter of chitterlings, who thereafter became a hunter of cabin-boys. The pig was still at large, healthy and happy, when the sailors were rescued from the island in a starved and emaciated condition. "From which parable," Wells concluded, "it may be gathered that a partial enterprise is not always wiser or more hopeful than a comprehensive one."

In surveillance and monitoring, as in catching a pork chop, you simply have to go whole hog![4]

Those individuals who developed the surveillance program knew this; in fact, knew it better than I did. As many of you know, I have been a fairly vocal critic of portions of the surveillance and monitoring plan ...primarily because it didn't provide *me* with precisely the data *I* needed to do *my* research. It only provided hints at what was needed. I was critical because -- and this pains me greatly to say -- I was fundamentally ignorant of the history, mission, function, and scope of the plan. A research administrator, as opposed to a research manager, is a nonessential individual who is capable of drawing a mathematically precise line from an unwarranted assumption to a foregone conclusion. I must confess that, with respect to the Great Lakes monitoring program, I fell into this trap. I failed to realize that surveillance verifies research; it is not intended to answer the research hypothesis

As I began to seek information for this presentation, however, some facts begin to emerge ...facts about which I was totally unaware. As members of this audience, I will not embarrass you by asking, except rhetorically, if you too were unaware of the enormity of scale of the program you are here to consider. It might be useful, however, if you answered the question in your own mind.

For example, were you aware that the entity -- surveillance and monitoring in the Great Lakes -- is unique in North America? Were you aware that it is unique in the world? Were you aware that it bears no relationship to any other site in this country, especially to those areas discussed at Stoney Brook, Pasadena, and New Orleans? Were you aware that, by the admission of the former administrators of EPA and NOAA, this country's longest term data base is the one developed under the surveillance and monitoring efforts in the Great Lakes? Did you know that the world's largest, historically continuous, most exhaustive, and most coordinated data set is the one which exists for the Great Lakes?

You might be surprised to learn that that data set -- with all of its problems that we complain about so much -- is the envy of a number of other nations, including the participant nations of the Rhine River Agreement (which, incidentally, was patterned after our own IJC), and the Soviet Union (which with all its resources and authoritarian control, still cannot mount a coordinated plan for surveillance of Lake Baikal, the largest lake in the world by volume).

Are you aware of what Great Lakes surveillance and monitoring has given the scientific research community, the residents of the Great Lakes Basin, and the citizens of both the U.S. and Canada? I wasn't.

I wasn't aware that the 1966-67 surveillance and monitoring data gave us our first real understanding of internal long-term loss rates in Lake Ontario. This function alone enabled the development of the first accurate and truly predictive models to be developed for the Great Lakes. What we have learned in the Great Lakes from that first coordinated monitoring data set has been used around the world.

I wasn't aware that utilization of the data acquired through surveillance and monitoring on Lake Michigan allowed the development of a mathematical model which resulted in the ban of the pesticide DDT throughout the nation.

I wasn't aware that the use of monitoring and surveillance data allowed adequate assessment of remedial measures for the pollutant mercury, and enabled the reopening of Great Lakes fisheries.

For the first time, I really understood how long term data were used to establish the target loadings for the renegotiated Water Quality Agreement in 1978, and I became impressed with the outstanding contributions of surveillance and monitoring to that whole Agreement.

I have heard it stated that surveillance and monitoring efforts have not made substantial contributions to new and emerging problems. Imagine my surprise when I discovered that, not only was DDT banned on the basis of monitoring data, but the basis for our knowledge of PCBs was rooted in the same source, and that the problem identified only a short time ago -- the occurrence of Tetrachloro Dibenzo para Dioxin (TCDD) -- was fundamentally related to surveillance, since the herring gull program is part of that function for the IJC.

Mathematical modelling is extensively used in the Great Lakes to make projections into the future. Mathematical models also seem to develop, of their own volition, an insatiable appetite for data. When I had acquired the basic facts about the size of our existing system, I was not surprised to learn that every numerical simulation, every mathematical model, and every predictive estimate dealing with the Great Lakes has exhaustively utilized the data base gathered by surveillance and monitoring.

I am not suggesting that the system is perfect. It obviously is not. I am suggesting that, if it is to be regarded at all, it must be considered from the basic premises upon which it was built. A useful plan must be sensitive to the questions being asked. In my case I was asking the wrong questions.

It must be understood that the system was wisely designed to have a very large moment of inertia. In short, it was deliberately constructed to

be resistant to rapid change. In order to be able to deal with long-term parameters of significance, the plan itself must be slow to change. It is absolutely essential that the basic long-term surveillance and monitoring measurements be made on spatial and temporal scales which are consistent with the corresponding space and time scale of each lake. In the Great Lakes, where enormous space and time scales prevail, you would *expect* the need for longer term information. Nearshore areas can and must be extensively sampled with high frequency, and the open lake considered over periods of longer duration.

In our haste to criticize the existing system, it is important not to lose sight of the fact that the ecosystem, and man's relationship to it, is a dynamic situation, one of a constantly evolving nature. It must also be recognized that the surveillance and monitoring plan is a slowly maturing system. Just as it was impossible to envision 1980's problems in 1960, it was not possible to design a study specifically for them. It was, however, possible to design a framework to incorporate them once they had been recognized. This is exactly what the surveillance and monitoring plan is capable of, and has undertaken.

The concept of peer review is excellent, and should be used at every appropriate opportunity. A peer review of the surveillance/monitoring plan, or its implementation, is essential. My chief concern is the role of this group. Does this assembly really constitute a peer review? Do you and I really represent the users of the data? Do we really represent those who are responsible for the state of the lakes?

I caution you against efforts to alter the plan. Suggest alterations to the implementation but not the plan itself. The existing data that resulted from the plan, for all their shortcomings, are too valuable, and the problems for which much of these data were gathered are a long way from solution. The plan itself, as I see it, is rather like the concept of democracy. Democracy is a lousy form of government -- but everything else is so much worse.

Because I happen to work for the Environmental Protection Agency, it might be assumed that I am presenting "the party line"; I want to state unequivocally, that this is not the case. Those of you who know me, know that this would not be the case. Before I began the preparation of this presentation, I was on the opposite side of the issue, feeling that my individual and personal needs were not being met. It wasn't until I began to examine the intent of the program, that I realized it was not supposed to. I had made the all too common error of confusing surveillance and monitoring with a research function. It was only when my perspective began to widen that I began to see the immense value that such a long-term overview had to offer.

To evaluate the plan, it is first necessary to separate research from monitoring. Then, in the light of the scope of the plan, two questions that deal with the implementations of the plan should be asked:

1. Are we doing the right surveillance and monitoring, and
2. Are we doing surveillance and monitoring right?

References

1 Poetry of Gwen Frostic, reprinted in a 1980 article by Eleanor Hill Shafer in *The Michigan Herbalist.*

2 Comparative fish contamination values taken from the synoptic survey data of the U.S. Fish and Wildlife Service. These data were utilized as they represent the most consistent time-series data set on Lake Michigan fish.

3 Data from H.E.B. Humphrey, Michigan Department of Public Health, in a manuscript entitled *Evaluation of Changes of the Level of Polychlorinated Biphenyls (PCB) in Human Tissues.*

4 I am indebted to my friend and colleague Jack Vallentyne for recalling the H.G. Wells' parable in his remarkable address as President of Societas Internationalis Limnologiae Theoretical et Applicatae (SIL) 25 August, 1980 in Kyoto, Japan, entitled *No Association is an Island.*

About the Author

Dr. Wayland Swain is the Director of the Large Lakes Research Station of the United States Environmental Protection Agency, located at Grosse Ile, Michigan.

PROJECTED CLOSING

One of the cost cutting measures proposed in United States President Ronald Reagan's budget is the closing of the Environmental Protection Agency's Large Lakes Research Station at Grosse Ile. The Station has long been involved in programs under the Great Lakes Agreement. Staff at the Station perform research into the natural processes in the Great Lakes System, providing data which assist agencies to better design programs to meet their Agreement obligations. The surveys of the Upper Lakes which Dr. Swain refers to were in part performed by the Grosse Ile group. Grosse Ile participated in the Lake Huron survey of 1976 and the more recent 1980 cruise as part of the International Surveillance Plan. The Laboratory also has been instrumental in the development and use of predictive models of the Great Lakes System.

Other proposed cuts which affect the Great Lakes community are the dismantling of the Great Lakes Basin Commission and all other River Basin Commissions across the United States, the ending of all Sea Grant programs, and the elimination of funding to Coastal Zone planning programs.

THINGS TO SEE

From *Minnesota Out of Doors*, January 1981, here is a selected list of rent-free outdoor films:

"Wildlife - Our Threatened Heritage", 30 minutes, NWF. Shows how man, through destruction of wildlife habitat and use of pesticides and pollutants, has jeopardized our heritage of a clean, beautiful land, abundant with wildlife. It makes a strong case for the conservation, wise use, and management of our natural resources. Order from Library, National Wildlife Federation, 1412 16th St., N.W., Washington, D.C. 20036, (202) 797-6828.

"It's Your Coast", 28 minutes, National Oceanic and Atmospheric Administration. Discusses land use problems with all types of people who are interested in the coast and coastal zone management. The subjects are land development, oil pollution, and beach erosion. Order from NOAA: Motion Picture Service, Department of Commerce, 12231, Wilkins Avenue, Rockville, Maryland, 20852 (301) 443-8411.

"The City - A Study in Survival", 28 minutes, German Information Center. Media all over the world are focusing on urban renewal and environmental conservation. This film shows viewers what can and is being done in the sprawling industrial region of the Rhur River in Germany. Order No. 2682: Association Films, Inc., Dublin, California 94566, 6644 Sierra Lane, (415) 829-2300.

"The Promise of Greener Days", 28 minutes, French Ministry of Foreign Affairs. Probing the mutual environmental responsibilities shared in solving pollutant problems by government, industry and individuals, this film makes clear that the problems along France's Seine are no different from those along any major American river. Order No. Q-154 from Association Films, Inc. (address above).

"Water Passages" is a 30-minute, 16 mm color film which examines the use of land treatment of municipal wastewater in five U.S. communities. The film is geared to the general public and may be particularly helpful to anyone who faces decisions about finding better and alternative ways to meet stringent wastewater treatment standards. Loan copies are free from Modern Talking Pictures, Scheduling Center, 5000 Park Street North, St. Petersburg, Florida 33709, (813) 541-7571. (Films are shipped from regional offices.)

"Your land, my land, our water" is a 16 mm, 30-minute color film which gives an up-to-date look at the continuing efforts of individuals, agencies and governments to reach the 1983 water quality goals set forth in United States Public Law 92-500. Through 31 people's stories, the film shows how improvements in water quality are brought about. IJC-Windsor has a free loan copy of the film. Write to the *FOCUS* Editor to arrange shipment.

PACE

Since its inception 10 years ago an organization known as PACE, the Petroleum Association for Conservation of the Canadian Environment, has been working quietly but efficiently to improve the quality of waters discharged from refineries into the Great Lakes.

PACE is made up of twelve companies ranging from large to small that contribute manpower and money to a wide variety of activities related to pollution control in the industry. By pooling information and resources, the industry has been able to fund research projects to find solutions to common environmental problems, and to find ways of protecting the environment in the petroleum refining, transportation and marketing networks.

PACE operates with 12 committees studying various aspects of the environment such as air quality, waste disposal, oil spills and water quality. Prominent among them is the Water Quality Committee, headed by Chairman Peter T. Budzik of Shell Canada Limited.

The Water Quality Committee assists government agencies and such bodies as the International Joint Commission by providing technical comment on proposed legislation and water quality objectives for the Great Lakes. It identifies and carries out research studies to fill information gaps in environmental knowledge. The committee also carries out an educational role on environmental issues, for members of industry and others. This article is the Committee's contribution to *Focus*.

As an example of research work, PACE in conjunction with Environment Canada, sponsored a study of sublethal effects of treated petroleum refinery effluent water carried out by Dr. John Sprague of Guelph University. Effects on growth, reproduction, avoidance behaviour and life stages of rainbow trout and a species of water

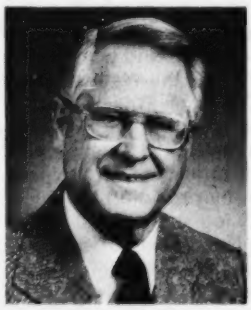
flea called *Daphnia pulex* were examined. The study concluded that with the high level of treatment currently in practice, none of the effects measured in the study would be evident at the periphery of a mixing zone.

Another research project funded by PACE was to look for trace substances in industry effluents that may have toxic effects. Sampling and analytical methods received special attention because of the very low levels likely to be encountered (parts per billion or parts per trillion range). The first phase of this study is now being evaluated and Phase 2 is currently being planned in cooperation with the Environmental Protection Service of Environment Canada.

In the field of education, the Water Quality Committee periodically holds workshops for people who design and operate wastewater treatment plants. These forums stimulate new ideas and lead to more efficient industrial water treatment design and operation.

In 1981, Chairman Budzik says, "the Water Quality Committee is continuing to support research to expand the trace substances survey, look at mathematical modelling of mixing zones, other potential biological impacts of treated wastewaters, and will be continuing its educational program mainly in aquatic toxicology for this year."

PACE supports the goals of the International Joint Commission and is hopeful that the results of the PACE Research programs, and other technical input, will make a contribution to the continuing success of the work of the Commission.



W. Donald Broughton is the newly elected president of PACE. He is Co-ordinator, Environmental Research and Policy, for Petro-Canada in Calgary.

EVENTS

An "International Conference on Atmospheric Deposition" will be held on May 19 and 20, 1981, at the Bismarck Hotel, Chicago, Illinois. Sponsors include the United States Environmental Protection Agency, Canadian Consulate General - Chicago, Illinois Institute of Natural Resources, Illinois Environmental Protection Agency, Illinois Pollution Control Board, Water Resources Center of the University of Illinois and several industries.

Key research people, and speakers from government and industry from Canada, the United States, and Europe will discuss: the causes and formation of atmospheric deposition (long and short range); health effects; update on research including control technologies; a look to the future; economic trade-offs involved in controlling atmospheric deposition will be evaluated; both beneficial and deleterious aspects of atmospheric deposition (including acid rain).

For conference program and details write to Eileen L. Johnston, Conference Organizer, at 505 Maple Avenue, Wilmette, Illinois, 60091, or phone her at (312) 793-7694.

The Canadian Water Resources Association's 34th National Conference will be held June 10-12, 1981 in Banff, Alberta. The theme is "Canadian Water Resources - Constraints on the Future". For further information contact: Mr. D. Mortin, Underwood McLellan Ltd., 2540 Kensington Road N.W., Calgary, Alberta, T2N 3S3.

Water Reuse Symposium II will be held August 23-28, 1981 in Washington, D.C. This is the second week-long conference devoted entirely to the renovation and reuse of wastewaters from municipal, industrial, and agricultural sources. Over 175 technical papers and poster presentations will be offered, emphasizing information transfer. Registration forms and preliminary program are available from: Water Reuse Symposium II, AWWA Research Foundation, 6666 West Quincy Avenue, Denver, Colorado, 80235, (303) 794-7711, ext. 251, 259.

The Twenty-fourth Conference on Great Lakes Research and the Annual Meeting of the International Association for Great Lakes Research will be held on the campus of The Ohio State University in Columbus, Ohio on April 28-30, 1981. The Ohio State University, Center for Lake Erie Area Research and the United States Environmental Protection Agency, Large Lakes Research Station are serving as co-hosts for the Conference.

The purpose of the Conference is to stimulate information exchange on all aspects of theoretical and experimental research having a direct relation to the Great Lakes or applicable to the understanding of large lakes in general. Papers related to the physical, chemical, geological, biological, technological and socio-economic problems of the Great Lakes will be presented. The meetings will include a half-day plenary in

which each of the Great Lakes will be addressed by a prominent researcher and two-and-one-half days of technical sessions.

For further information contact: Conference Coordinator, Center for Lake Erie Area Research, 484 West Twelfth Avenue, Columbus, Ohio, 43210, (614) 422-8949.

The Ontario Region of the Canadian Society for Civil Engineering, in cooperation with the Department of Civil Engineering, University of Windsor, is sponsoring a Conference on the "Application of Hydraulics in Municipal Engineering" at Windsor, Ontario, on Friday, April 24, 1981. Details from Dr. J.A. McCorquodale, Department of Civil Engineering, University of Windsor, Windsor, Ontario, N9B 3P4, (519) 253-4232, Ext. 514 or 294.

On October 4 to 7, 1981 in Kitchener-Waterloo, Ontario there will be a symposium - River Basin Management: Canadian Experiences. It will focus upon strategic issues associated with river basin management in Canada with particular attention to:

(1) identifying and defining management problems;
(2) identifying and developing alternative solutions;
(3) choosing among alternatives;
(4) implementing selected plans; and
(5) monitoring and evaluating the implemented activities.

Though the majority of the speakers will be invited, volunteered papers are also welcome. For further information, contact Bruce Mitchell, Dept. of Geography, University of Waterloo, Waterloo, Ontario N2L 3G1 or telephone (519) 885-1211.

Water Industry '81, the first International Conference and Exhibition, will be held at the Metropole Convention Centre, Brighton, UK from June 15-19, 1981.

Themes for the first Conference will cover, water resources - conservation and development, water supply - treatment and distribution, water quality and health, sewerage and sewage treatment, sludge treatment and disposal, industrial waste treatment and control, process technology development, monitoring and instrumentation, river quality management, fisheries and amenities.

For further information contact the Secretariat - Water Industry '81, 26 Albany St., Edinburgh, EH1 3QH, UK or telephone (031) 557-2478.

The Great Lakes Institute of the University of Windsor will sponsor "The Great Lakes in the '80's", A Symposium to Mark the Founding of the Great Lakes Institute, University of Windsor, at the University Centre, May 21-22. Outstanding speakers will explain their views on the future of the lakes - in water quality, atmospheric inputs, transportation, environmental law and as an energy system. The public is invited. For details contact: Marie Sanderson, Director, Great Lakes Institute, University of Windsor, Windsor, Ontario N9B 3P4, (519) 253-4232.

COOPERATIVE EXTENSION SERVICE CAN HELP

by W.A. van Eck

The Cooperative Extension Service was organized within the U.S. Department of Agriculture in 1914 as a rural education and information venture financed jointly by county, state, and federal governments. Broad areas of concern were programs for agriculture and natural resources, community development, family development and home economics, and youth. Qualified technical specialists implement these programs on a statewide or regional basis.

One area of concern for the Cooperative Extension Service is wastewater disposal for rural homes and communities. According to a recent estimate, at least one-fourth of the housing units in the United States are served by onsite wastewater disposal systems, and most of these are in rural areas. Because of the increasing cost of collection sewers and a national policy favoring development of more appropriate onsite water treatment and disposal, this number is likely to grow.

In spite of their common occurrence and simplicity, however, septic tanks and soil absorption fields are among the least understood and most neglected household facilities. Homeowners can be victims of a builder's faulty design or careless construction or of their own ignorance and abuse by failing to service or maintain their systems. Malfunction can be a nuisance and even a potential public health hazard to the community, causing unwarranted criticism or rejection of this type of wastewater treatment system by citizens and public officials.

Because these problems of misapplication and misuse are found in virtually every state, the

Cooperative Extension Service has begun to develop rural and suburban education capabilities to help answer citizens' questions on wastewater disposal. Anyone interested in such service should contact the local county office of his state's Cooperative Extension Service for further information.

The Cooperative Extension Service sometimes collaborates with land grant university researchers on potential improvements to small wastewater disposal systems. Most research in this area is performed by sanitary and agricultural engineers, soil scientists and bacteriologists. Research topics are often suggested by specialists from each state's Cooperative Extension Service who are acquainted with the research capabilities of their campus colleagues, with the "state of the art" in their field of expertise, and with the terrain conditions and community facilities around their states. When asked to present talks or demonstrations in the counties, technical specialists work closely with the staff in the county Extension Service offices. A County Extension Agent or Director can also take a problem to the university for further study, or he can obtain pertinent bulletins for constituents.

The Extension Service may also organize seminars and workshops on small wastewater disposal systems, publish bulletins and make other information available. Cooperative Extension specialists have lectured at national seminars and have published in technical and popular journals.

The names and addresses of local Extension contacts may be obtained from the Clearinghouse by calling toll-free: (800) 624-8301. Because of their knowledge of local conditions and personnel, the contact persons can adequately answer most questions. (From *Small Flows* newsletter, December 1980)

About the Author
Dr. W.A. van Eck is the Cooperative Extension Service contact person at West Virginia University-Morgantown.

FOR ADDITIONAL COPIES

Write to Patricia Bonner, Editor, Great Lakes Focus, IJC Regional Office, 100 Ouellette Avenue, Windsor, Ontario Canada N9A 6T3.

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